IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Patent Application of Qingqiao Wei Application No.: 10/807,932 Filed: March 23, 2004 For: Fluid Sensor and Methods	Group Art Unit: 1797 Examiner: WHITE, Dennis M. Confirmation No.: 5174

REPLY BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is a Reply Brief under Rule 41.41 (37 C.F.R) in response to the Examiner's Answer of April 28, 2010 (the "Examiner's Answer" or the "Answer"). In Section 10, the Answer contains a response to some of the arguments made in Appellant's brief. Appellant now responds to the Examiner's Answer as follows.

Status of Claims

The status of the claims remains unchanged. Claims 4-5, 11-13, 16, 19, 25, 26, 28, and 32-35 have been cancelled previously without prejudice or disclaimer. Claims 1-3, 6-10, 14, 15, 17, 18, 20-24, 27, 29-31, and 56-59 are currently pending in the application and stand finally rejected. Accordingly, Appellant appeals from the final rejection of claims 1-3, 6-10, 14, 15, 17, 18, 20-24, 27, 29-31, and 56-59.

Grounds of Rejection to be Reviewed on Appeal

The Answer maintains the following grounds of rejection.

(1) Claims 1, 2, 6-10, 14, 15, 17, 18, 20-24, 27, 29-31, and 56-59 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,509,619 to Kendall et al. (hereinafter Kendall) in view of *Journal of Microelectromechanical Systems*, Briand et al,, vol. 9, no. 3, September 2000 (hereinafter Briand).

(2) Claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over Kendall, in view of Briand, and further in view of U.S. Patent No. 3,897,274 to Stehlin et al (hereinafter Stehlin).

Accordingly, Appellant hereby requests review of each of these grounds of rejection in the present appeal.

Argument

(1) Claims 1, 2, 6-10, 14, 15, 17, 18, 20-24, 27, 29-31, and 56-59 are patentable over Kendall and Briand:

Claims 1 and 56:

Claim 1 recites:

A fluid sensor on a substrate for use in an environment having an ambient temperature, the fluid sensor comprising:

a) a field-effect transistor (FET) disposed on the substrate comprising a functionalized semiconductor nano-wire, ***the functionalized semiconductor nano-wire including at least one catalyst, the catalyst comprising a material capable of interacting with a fluid to be sensed and effecting a change of an electrical characteristic of the FET***,

b) a control device on the substrate comprising a non-functionalized semiconductor nano-wire otherwise identical to the FET,

c) an integral heater disposed proximate to the field-effect transistor to heat the field-effect transistor to an elevated temperature relative to the ambient temperature,

d) ***an integral temperature sensor on the substrate configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity***; and

e) integral thermal insulation disposed on the substrate to maintain the field-effect transistor at the elevated temperature ***wherein selection of the FET operating temperature by measurement of the integral temperature sensor, a particular fluid may be detected***.

(Emphasis added).

Claim 56 similarly recites:

A fluid sensor on a substrate for use in an environment having an ambient temperature, the fluid sensor comprising:

a) a field-effect transistor (FET) comprising a functionalized semiconductor nano-wire, ***the functionalized semiconductor nano-wire including at least one coating, the coating including a substance capable of interacting with a fluid to be sensed and effecting a change of an electrical characteristic of the FET***,

b) a control device on the substrate comprising a non-functionalized semiconductor nano-wire otherwise identical to the FET,

c) an integral heater disposed proximate to the field-effect transistor to heat the field-effect transistor to an elevated temperature relative to the ambient temperature,

> d) ***an integral temperature sensor configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity***; and
> e) integral thermal insulation disposed on the substrate to maintain the field-effect transistor a the elevated temperature, ***wherein selection of the FET operating temperature by measurement of the integral temperature sensor, a particular fluid may be detected***.

(Emphasis added).

In contrast, Kendall and Briand do not teach or suggest "[a] fluid sensor on a substrate for use in an environment having an ambient temperature, the fluid sensor comprising a field-effect transistor (FET) disposed on the substrate comprising a functionalized semiconductor nano-wire, the functionalized semiconductor nano-wire including at least one catalyst, the catalyst comprising a material capable of interacting with a fluid to be sensed and effecting a change of an electrical characteristic of the FET . . . and an integral temperature sensor on the substrate configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity . . . wherein selection of the FET operating temperature by measurement of the integral temperature sensor, a particular fluid may be detected." (Claim 1) (*See also*, similar recitations in claim 56). The Examiner's Answer argues entirely on the premise that Appellant's previous arguments are directed towards functional processes that are given no patentable weight in apparatus claims, or are arguments surrounding intended use. (See, Examiner's Answer, pp. 9-10). Appellant respectfully disagrees.

Contrary to these assertions, Appellant has previously argued that (1) both Kendall and Briand fail to teach or suggest, "***an integral temperature sensor*** on the substrate ***configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity***" (Claims 1 and 56) (emphasis added), (2) both Kendall and Briand fail to teach or suggest a system configured to perform a temperature based selection

of various gases with a sensor using the same catalyst (*See*, recitation "a" of claims 1 and 56), (3) the systems and methods taught by Kendall and Briand would lead one of ordinary skill in the art away from the system as claimed by Appellant, and (4) that Kendall teaches away from the combination with Briand because Kendall uses the oxide thickness as an adjustment to detect different sized and shaped molecules. (*See generally*, Appeal Brief of September 11, 2009 (hereinafter, Appeal Brief)).

Clearly, in light of the above summary of arguments, the nature of these Appellant's previous arguments are based on patent law doctrines separate and apart from "functional processes that are given no patentable weight in apparatus claims", or "intended use." Therefore, Appellant respectfully requests substantive consideration of Appellant's previous arguments. Further, Appellant's above numerated arguments will be addressed in order below.

First, both Kendall and Briand fail to teach or suggest, "***an integral temperature sensor*** on the substrate ***configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity***" (Claims 1 and 56) (emphasis added). The final Office Action of March 25, 2009 (hereinafter, the final Office Action) concedes, "Kendall is silent about the device further comprising a control device on the substrate comprising a non-functionalized semiconductor nano-wire otherwise identical to the FET and ***at least one integral temperature sensor on the substrate***." (final Office Action, p. 3) (emphasis added). Thus, the final Office Action cites to Briand and argues, "Briand et al teach a MOSFET array gas sensor comprising . . . a temperature sensor diode . . . ." (*Id.*).

However, Briand also fails to teach or suggest, "an integral temperature sensor on the substrate ***configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity***." (Claims 1 and 56) (emphasis added). Briand

discloses only that the integral heater to heat the gas sensors to *typical operating temperatures* at about 140 °C and 170 °C (*See*, Briand, p. 305, second column, first partial paragraph and first full paragraph) and that the actual selection of gas sensitivity is performed by having the "GasFets having three different catalytic metals." In other words, Briand operates the sensors only at typical operating temperatures required for operation but selects the individual gases by having different catalytic metals on each sensor. Thus, like Kendall, Briand also fails to teach or suggest, "an integral temperature sensor that is configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity." (Claims 1 and 56).

Second, both Kendall and Briand fail to teach or suggest a system configured to perform a temperature based selection of various gases with a sensor using the same catalyst (*See*, recitation "a" of claims 1 and 56). As similarly argued above in connection with item 1, Briand selects the individual gases by having different catalytic metals on each sensor. Further, Kendall uses the oxide thickness as an adjustment to detect different size and shaped molecules (col. 9, lines 21-23). Thus, neither Kendall nor Briand teach or suggest a system configured to perform a temperature based selection of various gases with a sensor using the same catalyst (*See*, recitation "a" of claims 1 and 56).

Third, in connection with the second issue addressed directly above, both Kendall and Briand would lead one of ordinary skill in the art away from the system as claimed by Appellant. This is because the systems of both Kendall and Briand teach away from the recitations of claims 1 and 56 by requiring the detection of gases or fluids by other means. As demonstrated in Appellant's Appeal Brief, combining Briand with Kendall does not produce the Applicant's claimed sensor because Briand acknowledges it does not do so. On page 306, second column, first partial paragraph, Briand teaches, "[f]urther investigations are needed to

evaluate the effect of different temperature profiles during the gas measurements in the aim of improving the gas sensitivity and selectivity. More measurements need to be performed before a conclusion can be drawn about the way the signal from the reference sensor can be used." Accordingly, Briand does not enable Applicant's claimed invention because Briand doesn't even know if his sensor is capable of such operation or that even a more sensitive type of sensor will be required such as Applicant's FET with a functionalized semiconductor nano-wire with either a catalyst (claim 1) or other coating (claim 56).

Fourth, Kendall teaches away from the combination with Briand because Kendall uses the oxide thickness as an adjustment to detect different sized and shaped molecules. This is in direct contrast to the system of Briand that requires the use of different catalytic metals on each sensor to select gases. As similarly argued in Appellant's Appeal Brief, Kendall does not suggest looking to Briand as Kendall uses the oxide thickness as an adjustment to detect different size and shaped molecules (col. 9, lines 21-23). Kendall does not suggest doing it otherwise, and, in fact, Kendall uses nano-wires to make atomic ridges (col. 5, lines 45-59) which are used to provide grooves in the substrate in which long chain molecules are deposited (col. 8, lines 45-51). The nano-wires can even be removed from Kendall (col. 5, lines 60-65). Kendall does not have a "functionalized semiconductor nano-wire" but really has "at least one elongated molecule located in at least one of the nanogrooves" (see abstract and Fig. 3). Accordingly, Kendall does not teach or disclose using the temperature along with the sensitivity of nano-wires to perform the gas sensitivity selection. Therefore, there is no teaching or suggestion that would motivate one of ordinary skill in the art to combine the nano-wires of Kendall with the teachings of Briand to arrive at the Applicant's claimed invention, particularly, that of using the combination of nano-wires, temp-sensors, heaters,

and reference sensors to create a gas sensor that can *detect various gases based on changing the temperature of a FET with a functionalized semiconductor nano-wire*.

In contrast, claim 1 recites, "[a] fluid sensor on a substrate for use in an environment having an ambient temperature, the fluid sensor comprising a field-effect transistor (FET) disposed on the substrate comprising a functionalized semiconductor nano-wire, ***the functionalized semiconductor nano-wire including at least one catalyst, the catalyst comprising a material capable of interacting with a fluid to be sensed and effecting a change of an electrical characteristic of the FET***, . . . ***an integral temperature sensor on the substrate configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity***, and integral thermal insulation disposed on the substrate to maintain the field-effect transistor at the elevated temperature ***wherein selection of the FET operating temperature by measurement of the integral temperature sensor, a particular fluid may be detected***." Similar recitations may be found in claim 56. Thus, the subject matter of claims 1 and 56 are not taught or suggested by Kendall and Briand.

The Supreme Court recently addressed the issue of obviousness in *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727 (2007). The Court stated that the *Graham v. John Deere Co. of Kansas City*, 383, U.S. 1 (1966), factors still control an obviousness inquiry. Under the analysis required by *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966), to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art. In the present case, the scope and content of the prior art, as evidenced by Kendall and Briand, did not include the claimed subject matter, particularly a] fluid sensor on a substrate for use in an environment having an ambient temperature, the fluid sensor comprising a field-effect transistor (FET) disposed on the substrate comprising a

functionalized semiconductor nano-wire, the functionalized semiconductor nano-wire including at least one catalyst, the catalyst comprising a material capable of interacting with a fluid to be sensed and effecting a change of an electrical characteristic of the FET, an integral temperature sensor on the substrate configured to allow control and selection of temperatures for at least one of calibration and setting of gas sensitivity, and integral thermal insulation disposed on the substrate to maintain the field-effect transistor at the elevated temperature wherein selection of the FET operating temperature by measurement of the integral temperature sensor, a particular fluid may be detected.

The differences between the cited prior art and the indicated claims are significant because the recitations of claims 1 and 56 provide for the use of a control sensor along with calibration of the control sensor and gas sensors over temperature along with the functionalized semiconductor nano-wire in both the control sensor and FET sensor to get the required sensitivity that changes an electrical characteristic of the FET sensor sufficient to distinguish different gases over a temperature range. Thus, the claimed subject matter provides features and advantages not known or available in the cited prior art. Consequently, the cited prior art will not support a rejection of claims 1 and 56 under 35 U.S.C. § 103 and *Graham*. Therefore, for at least the reasons explained here, the rejection based on Kendall and Briand of claims 1 and 56 and their respective dependent claims should not be sustained.

<u>(2) Claim 3 is patentable over Kendall, Briand, and Stehlin:</u>

This rejection should not be sustained for at least the same reasons given above in favor of the patentability of claim 1.

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the Rejection of March 25, 2009 is respectfully requested.

Respectfully submitted,

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/Steven L. Nichols/
Steven L. Nichols
Registration No. 40,326

STEVEN L. NICHOLS
Director, Intellectual Property Practice Group
VANCOTT PC
36 SOUTH STATE STREET, SUITE 1900
SALT LAKE CITY, UT 84111
P 801.237.0251
M 801.414.0750
F 801.237.0853
E snichols@vancott.com